

The Phase Diagram of Iron by *in-situ* X-ray Diffraction Studies at the Earth's Core Conditions*

C. S. Yoo, J. Akella, P. Söderlind, J.A. Moriarty (Lawrence Livermore National Laboratory, Livermore, CA 94551; e-mail: yoo1@llnl.gov)
A. Campbell, D. Mao, R. Hemley (Geophysical Laboratory in Carnegie Institute, Washington D.C. 20015)

The phase diagram of iron has been studied to 300 GPa and 3500 K by *in-situ*, X-ray diffraction studies of laser heated iron in a diamond anvil cell. The results reveal several important constraints for the phase diagram of iron. First, a new phase of iron, ϵ -Fe, is found between 15 and 40 GPa. It is a dhcp structure with a ABAC stacking sequence and the c/a ratio of 1.633. Second, the ϵ/γ /liquid triple point of iron is located at 2500 ± 200 K and 50 ± 10 GPa, substantially lower pressure than the previous result. Third, ϵ -Fe is stable in a wide range of temperatures between 50 GPa and 110 GPa. No evidence was found for any other phases including β - and α '-Fe. Fourth, above 110 GPa there is an indication of new crystalline, arising either from a solid-solid transition or from a chemical reaction of ϵ -Fe. The implications of these results for the Earth's core will also be discussed.

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2. 01525311
3. (a) C.S. Yoo
L-299
Lawrence Livermore Natl. Lab.
Livermore, CA 94551
(b) Tel: (510) 422 - 5848
(c) Fax: (510) 422 - 2851
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